



Designation: C 490 – 04

Standard Practice for Use of Apparatus for the Determination of Length Change of Hardened Cement Paste, Mortar, and Concrete¹

This standard is issued under the fixed designation C 490; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This practice covers the requirements for the apparatus and equipment used to prepare specimens for the determination of length change in hardened cement paste, mortar, and concrete, the apparatus and equipment used for the determination of these length changes, and the procedures for its use.

1.2 Methods for the preparation and curing of test specimens, conditions of testing and curing, and detailed procedures for calculating and reporting test results are contained in applicable test methods.

1.3 The values stated in SI units or inch-pound units are to be regarded as standard. The values in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in nonconformance with the standard.

2. Referenced Documents

2.1 *ASTM Standards*:²

C 511 Specification for Moist Cabinets, Moist Rooms, and Water Storage Tanks Used in the Testing of Hydraulic Cements and Concretes

C 1005 Specification for Reference Masses and Devices for Determining Mass and Volume for Use in the Physical Testing of Hydraulic Cements

3. Terminology

3.1 *length change*—an increase or decrease in the linear dimension of a test specimen, measured along the longitudinal axis, due to causes other than applied load.

4. Significance and Use

4.1 This practice is intended to provide standard requirements for apparatus common to many test methods used in connection with cement and concrete and standardized procedures for its use. The detailed requirements as to materials,

mixtures, specimens, conditioning of specimens, number of specimens, ages at which measurements are to be made, interpretation of results, and precision and bias are left to be dealt with in specific test methods.

5. Apparatus

5.1 *Reference Masses and Devices for Determining Mass and Volume*, shall conform to the requirements of Specification **C 1005**.

5.2 *Molds*, shall have either one or two compartments and shall be constructed as shown in **Fig. 1** or **Fig. 2**. Molds for test specimens used in determining the length change of cement pastes and mortars shall provide for 25 by 25 by 285-mm prisms having a 250-mm gage length, or for 1 by 1 by 11¼-in. prisms having a 10-in. gage length. Molds for test specimens used in the length change of concretes shall provide for prisms of the desired cross section having a 10-in. or 250-mm gage length. In some routine tests, 25 by 25 by 160-mm specimens with a gage length of 125 mm, or 1 by 1 by 6¼-in. specimens with a gage length of 5-in. are permitted, but in case of dispute, results obtained with specimens of 250-mm [10-in.] gage length shall govern.

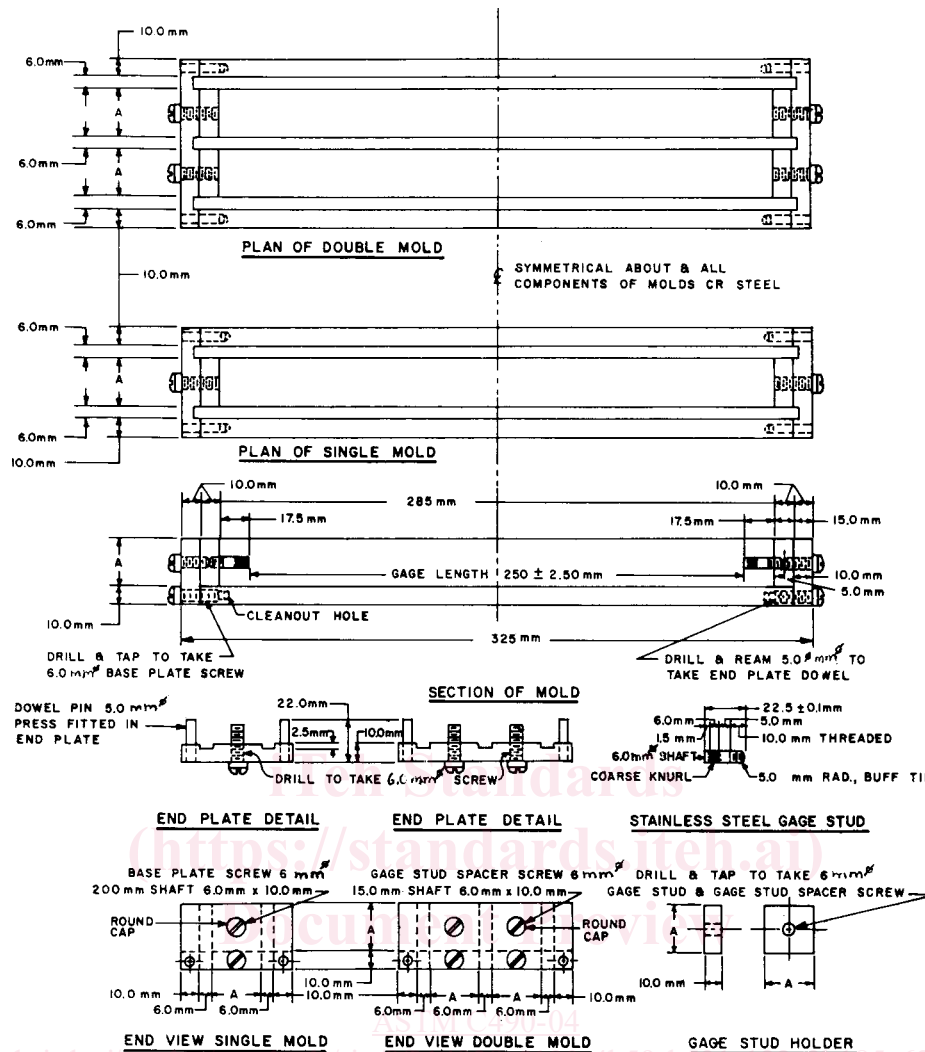
5.2.1 The gage length shall be considered as the nominal length between the innermost ends of the gage studs. The parts of the molds shall be tight fitting and firmly held together when assembled, and their surfaces shall be smooth and free of pits. The molds shall be made of steel or other hard metal not readily attacked by the cement paste, mortar, or concrete. The sides of the molds shall be sufficiently rigid to prevent spreading or warping. For the molds shown in **Fig. 1**, the tolerance on dimension A is ± 0.7 mm. For the molds shown in **Fig. 2**, the tolerance on dimension A is ± 0.03 in.

5.2.2 Each end plate of the mold shall be equipped to hold properly in place, during the setting period, one of the gage studs shown in **Fig. 1** or **Fig. 2**. The gage studs shall be of American Iron and Steel Institute (AISI)³ Type 316 stainless steel or other corrosion-resistant metal of similar hardness. Gage studs of Invar or similar metal shall be used when specimens are tested at widely different temperatures. To prevent restraint of the gage studs before demolding of the

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

³ Details on this material are available from the American Iron and Steel Institute, 1133 15th St. N.W., Washington, DC 20005.



NOTE—Dimension A to be specified by the purchaser.

FIG. 1 Molds (SI Units)

specimen, the device for holding the gage studs in position shall be so arranged that, if necessary, it can be partially or completely released after the compaction of the paste or mortar into place in the mold. The gage studs shall be set so that their principal axes coincide with the principal axis of the test specimen. For the molds shown in Fig. 1, gage studs shall extend into the specimen 17.5 ± 0.5 mm and the distance between the inner ends of the gage studs shall be 250.0 ± 2.5 mm and 250 mm shall be considered the gage length for calculating length change. For the molds shown in Fig. 2, gage studs shall extend into the specimen 0.625 ± 0.025 in. and the distance between the inner ends of the gage studs shall be 10.00 ± 0.10 in. and 10 in. shall be considered the gage length for calculating length change.

5.3 Length Comparator, for determining length change of specimens, shall be designed to accommodate the size of specimen employed and to provide or permit a positive means of contact with the gage studs and the convenient and rapid obtaining of comparator readings (Note 1).

5.3.1 The comparator for determining length changes of specimens produced in the molds shown in Fig. 1 shall provide

a dial micrometer or other measuring device graduated to read in 0.002-mm units or less, accurate within 0.002 mm in any 0.020-mm range, and within 0.004 mm in any 0.200-mm range, and sufficient range (at least 8.0 mm) in the measuring device to allow for small variations in the actual length of various specimens. The terminals of the comparator shall be plane, polished and heat-treated. They shall be fitted with collars held in place with set screws. The collars shall extend 1.5 ± 0.1 mm beyond the plane face of the terminal and have an inside diameter 0.5 mm greater than the average diameter of the gage studs that must fit into the collars.

NOTE 1—One type of instrument that has been found satisfactory for use with small prisms is shown in Fig. 3. A horizontal comparator should be used with prisms with a cross section greater than 9 in.² or 58 cm².

5.3.2 The comparator for determining length changes of specimens produced in the molds shown in Fig. 2 shall provide a dial micrometer or other measuring device graduated to read in 0.0001-in. units, accurate within 0.0001 in. in any 0.0010-in. range, and within 0.0002 in. in any 0.0100-in. range, and sufficient range (at least 0.3 in.) in the measuring device to